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REVISION OF THE SPECIES OF LOPHOTOCARPUS OF THE
UNITED STATES: AND DESCRIPTION OF A NEW SPECIES
OF SAGITTARIA.

BY JARED G. SMITH.

LOPHOTOCARPUS.

ANALYTICAL KEY TO SPECIES.

Petioles and scapes about equal, very slender; leaves hastate; dorsal wing of the mature achene inflated.

Fertile pedicels 3-5 cm. long, very slender, shorter than the 2 or 3 internodes; beak of the achenea very short. *L. fluitans*.

Fertile pedicels equaling the internodes; verticils 5 or more.

L. Californicus.

Petioles thick and spongy, longer than the weak, ascending or at length decumbent scape; dorsal wing of the achene thin, flat, not inflated.

Leaves with sagittate or hastate blades, seldom bladeless. Plants growing in fresh water ponds and marshes.

Basal lobes of the leaves widely divergent: large plants, 2-6 dm. high. *L. calycinus*.

Basal lobes not widely divergent: low plants, 1-1.5 dm. high.

L. depauperatus.

Leaves mostly bladeless phyllodia. Submerged seashore and tidal flat aquatics.

Phyllodia thick, spongy, nodose, 1-3 dm. long. *L. spongiosus*.

Phyllodia flat, spatulate, not nodose, 3-7 cm. high. *L. spatulatus*.

LOPHOTOCARPUS FLUITANS (Engelm.). *Sagittaria calycina fluitans* Engelm. in Torr. Bot. Mex. Bound. Surv. 212. 1859.

Submerged aquatic with very slender erect petioles 3-5 dm. high. Mature leaves sagittate, 6-8 cm. long, acute, the basal lobes shorter or longer than the middle one, 2.5-5 cm. long, 5-6 mm. wide, the middle lobe lanceolate, acute, 3.5-5 cm. long, 10-15 mm. wide; basal lobes sometimes very short, or obsolete (when the blade is linear-lanceolate), obtuse at the apex, and rounded or truncate at the

base, 4–5 cm. long, 7–9 mm. wide. Scape as long as the leaves; verticils two or three; fertile pedicels slender, 3–5 cm. long; fruiting head 8 mm. in diameter. Achenia obovate-cuneate, 2 mm. long, with a somewhat rounded or inflated dorsal wing or crest extending from the base of the short beak. New Mexico: Type No. 1899, C. Wright, 1852. No. 679, Wright, 1849, New Mexico, may also be referred here though the only specimen examined was fragmentary and imperfect. — Plate 53.

LOPHOTOCARPUS CALIFORNICUS n. sp.

Submerged aquatic, 3–4 dm. high, with weak, slender, ascending petioles 3–4 dm. long. Blades hastate or sagittate, the middle lobes 4–8 cm. long, lanceolate, acute, 5-nerved, the basal lobes widely divergent, $\frac{1}{4}$ – $\frac{1}{2}$ as wide as the middle one, and shorter than or equaling it in length, linear-acuminate. Scape slender, nearly as long as the petioles, bearing 3–5 verticils of flowers, those of the two or three lowermost fertile. Bracts of the fertile whorls 6–7 mm. long, those of the upper staminate verticils 1 cm. long. Pedicels of the fertile florets 1–2 cm. long, equaling the staminate. Sepals orbicular, 6–9 mm. long. Verticils about the length of the fertile pedicels apart. Fruiting head 10–12 mm. in diameter. Immature achenia obcuneate, 1.5 mm. long, with a minute horizontal beak, broadly winged on each margin. — Plate 54.

Type No. 1136, S. B. & W. F. Parish, Coyote Creek, Los Angeles Co., California, October, 1891; also collected by J. A. Sanford, Stockton, Cal., July 16, 1893; both in Herb. Mo. Bot. Gard.

With the exception of an unidentifiable fragment in the Gray Herbarium, these collections are the only specimens of *Lophotocarpus* from California in either the Columbia, Harvard, St. Louis, or National Herbaria.

L. Californicus differs from *L. calycinus* in the very long, slender-petioled leaves, slender scape with 5 or more

verticils 1.5–2 cm. apart, and more broadly winged achenia, although mature specimens have not been seen. It is most closely related to *L. fluitans*, from which it differs in having widely divergent basal lobes, usually shorter than the middle one, more verticils less widely separated, larger fruiting head, shorter fertile pedicels, and more broadly winged and prominently beaked achenes.

LOPHOTOCARPUS CALYCINUS (ENGELM.). *Sagittaria calycina* Engelm. Torr. Bot. Mex. Bound. Surv. 212. 1859.

Leaves floating or ascending, 1.5–4 dm. high. Blades entire, hastate, sagittate, or triangular crescent-shaped, dorsal lobes usually widely divergent, 8–16 cm. long, 5–25 cm. wide, rounded, obtuse or acute at the apex. Basal lobes often much longer than the middle one. Scape shorter than the petioles, simple, weak, at length decumbent. Verticils 2–6; fertile pedicels very thick, recurved in fruit, equaling or longer than the slender sterile ones. Achenes obcuneate, truncate, 2–2.5 mm. long, narrowly winged on the margins, with a short, horizontal, triangular beak. In fresh water bogs and marshes, South Dakota to Louisiana and New Mexico, eastward to Delaware. Type specimens in the Engelmann Herbarium. July–September.

Specimens examined from South Dakota (No. 7, Potter, 1892; No. 3, Griffiths, Bangor, Sept. 13, 1892; No. 5 and 14, T. A. Williams, Canning, Aug. 16, 1892); Michigan (J. Schneck, Grand Rapids, Aug. 24, 1881); Nebraska (No. 307, T. A. Williams, Greenwood, July 16, 1890); Kansas (Mark White, Cowley Co., 1898; No. 535, Hitchcock, Finney Co., Aug. 13, 1895); New Mexico (No. 74, Wooton, Mesilla, July 2, 1897); Missouri (Dr. George Engelmann, various localities around St. Louis; Bush, 404, Courtney, Oct. 11, 1896, and 675, Watson, 1894; Hilgard, St. Louis, 1870; Eggert, St. Louis, 1877); Illinois (E. Hall, Athens, and Sangamon River, Sept., 1861, and Athens, Sept., 1865; Hitchcock, Cahokia, Aug. 13, 1890); Louisiana (Josiah Hale, Alexandria, the type of *Sagittaria calycina maxima* Engelm., with paniculate inflorescence and broadly triangular leaf-blades 30 cm. wide); Delaware (A. Commons, Delaware City, Sept. 18, 1894). *Sagittaria calycina media* Engelm., collected in saline ponds along the Meramec river near St. Louis, Mo., July, 1856, only differs in having crescent-shaped leaves, rounded at the apex.

LOPHOTOCARPUS DEPAUPERATUS (Engelm.). *Sagittaria calycina depauperata* Engelm. in herb.

Low, 1–1.5 dm. high. Petioles slender, ascending. Blades elliptical, hastate or sagittate, acute at the apex, 3-nerved, 2–4 cm. long, the lobes spreading. Scape one-half as long as the leaves. Fertile pedicels 1–3 cm. long. Fruiting head 7–8 mm. in diameter. Achenes obcuneate, truncate, 1.7 mm. long, 2 mm. wide, the slender horizontal beak one-third the width of the achene. Type collected by Dr. George Engelmann, Missouri, Sept., 1858. Margins of ponds, Wisconsin to the Indian Territory. June–September. — Plate 55.

Specimens examined from Wisconsin (T. J. Hale, Prairie du Chien, 1861); Illinois (H. M. Patterson, Oquawka); Missouri (Dr. Geo. Engelmann); Indian Territory (No. 331, E. Palmer, 1868; No. 268, M. A. Carleton, Cherokee Outlet, June 24, 1891).

LOPHOTOCARPUS SPONGIOSUS (Engelm.). *Sagittaria calycina spongiosa* Engelm. A. Gray, Manual, 5th edition, 493. 1867.

Submerged aquatic, with thick, spongy, nodose petioles and scapes. Petioles 1–2 dm. long. Blades spatulate and obtuse, or elliptical and truncate, or hastate, or sagittate, with the narrow, acute, falcately divergent lobes 2.5–10 mm. wide, sometimes 8 cm. long. Scape simple, not more than half as long as the petioles, spongy, weak, at first ascending, at length decumbent, bearing two verticils of one to three flowers each. Fertile pedicels much thickened, 1–2 or 3 cm. long, 3–5 or 6 mm. in diameter. Sepals broadly ovate, obtuse, scarious at the tip and margins, 10–12 mm. long. Fruiting head depressed-globose, 7–10 mm. in diameter. Achene 2–2.5 mm. long, obcuneate, with a narrow dorsal wing and a very short, ascending or horizontal beak. Margins of brackish ponds and tide-water marshes, New Brunswick to Virginia. Type collected by Edward Tatnall, Wilmington, Del., July, 1860, in Engelmann Herbarium. — Plate 56.

Specimens examined from New Brunswick (J. Fowler, Bass river, Kent Co., July 28, 1870); Maine (Swan, Kennebec, 1859); Massachusetts (W. Boott, Woburn Pond and Mystic River, 1863, and North Cambridge, Aug. 21, 1870); New Jersey (C. F. Austin, Hackensack River and New Durham, Aug., 1861; Wm. M. Van Sickle, Fairview, N. J., July 26, 1894); Virginia (F. V. Coville, Colonial Beach, July 6, 1890).

LOPHOTOCARPUS SPATULATUS n. sp.

Low aquatic, 3–7 cm. high, the phyllodia bladeless, or sometimes spatulately broadened at the tip, ascending, with the edges vertical through a twist in the base, 3–6 mm. wide, obtuse or rounded at the apex. Scape simple, usually shorter than the phyllodia, 3–4 cm. long, one or two-flowered, thickened and reflexed after flowering. Bracts minute, 3 mm. long, scarious, broadly ovate, obtuse. Stamens 6–9, the filaments flattened, incurved, broadest at the base, 1.5–2 mm. long, smooth, the anthers 1 mm. long, oblong. Sepals oblong-orbicular, thin, 3 mm. long, nerveless, thin-scarious on the margins, and papery in fruit. Petals ovate orbicular, obtuse, 6 mm. long. Achenia 1.5 mm., obliquely obovate, obtuse, narrowly winged on the back to about the level of the beak, and sometimes with a transverse lateral ridge near the top, with a slender, oblique or horizontal beak inserted below the apex. The phyllodia are frequently nodose towards the base. — Plate 57.

Collected by Alvah A. Eaton, Newburyport, Massachusetts, on sandy beaches along the Merrimac River, above salt water but within the influence of the tides. Mr. Eaton has had this plant under observation for five years, and says, concerning it: “The plant never gets larger, never has but one whorl of flowers, usually one or two, seldom three, on a scape. The fruit is buried in the mud in which the plant grows by the recurving pedicels and scape. Cultivation does not change the plant in the least, as I have had it in my water garden during the summer and in the greenhouse now.”

Type specimens in Herb. Mo. Bot. Garden, and in the National Herbarium. This plant seems to be well distin-

guished from *Sagittaria calycina spongiosa* Engelm. with the type specimens of which it has been compared. The latter is from 10–25 cm. high, the strongly nodose phyllodia often bearing elliptical blades 2–2.5 cm. long. The achenia of *L. spongiosus* are cuneate obovate, 2 mm. long, and broadly winged on both margins, with the stouter beak nearly even with the tip of the achenium. The flowers are nearly twice the size of those of *L. spatulatus*.

SAGITTARIA.

SAGITTARIA EATONI n. sp.

Monoecious, 1–2 dm. high. Phyllodia flat, broad at base, and gradually narrowed toward the tip. Leaf-blades when present linear-lanceolate, acute or acuminate, 2–3 cm. long, 2–4 mm. wide. Scape very slender, ascending, weak, 8–12 cm. high, bearing one, two, or rarely three verticils; bracts 2 mm. long, ovate, acute, connate. Fertile pedicels very slender, 5–8 mm. long, exceeded by the staminate ones. Flowers usually two pistillate and one staminate in the lowest verticil, the others all staminate. Sepals 4 mm. long, ovate-lanceolate, obtuse, 4–5 nerved, the nerves vanishing below the tip. Petals white, with a rose-colored spot at the base, broadly cuneiform-obovate, emarginate. Achenia not seen. Pistils very numerous in the female flower, 80–100, very minute. Stamens 12; filaments shorter than the anther, dilated at the base, pubescent. — Plate 58.

Collected by Alvah A. Eaton, Newburyport, Massachusetts, on sandy beaches along the Merrimac River, with *Eriocaulon septangulare*, between high and low tide, but above the influence of salt water. It is most closely related to *S. teres* S. Watson with which it has probably been confounded. It may be distinguished from that species by the flattened phyllodia which seem to be entirely without nodes, by the rose-colored bases of the petals, and by the fertile pedicels shorter than the staminate. I have seen

other specimens of this from Connecticut and the shores of Long Island, but from lack of full notes concerning habit of growth I have heretofore referred them to *S. teres*.

Mr. Eaton says: "This is peculiar on account of the extensive propagation by offshoots. It spreads by underground rootstocks or rhizomes, sometimes a dozen plants being joined, thus forming a complete carpet on the bottom in shallow places. The winter roots are like those of other *Sagittarias*. It likes positions where alternately covered and uncovered by the tides or where the sandy shore is ripple-swept. In the latter places it multiplies rapidly where its leaf-tips just emerge. Usually it is submerged and only blooms when it is so, at least for a part of the day by the tides. Its flowers open when the water is half way up. It does not seem to spread after it has been entirely left by the water, even though growing on the mud flats where it is very damp. It undoubtedly grows in all of our ponds with sandy shores."

EXPLANATION OF PLATES.

Plates 57 and 58 were drawn from the type material by Mr. A. H. Baldwin; the others, by Mr. J. B. S. Norton.

Plate 53, *L. fluitans*. — Plant, one-half size, and achenium, with cross-section of same, $\times 5$.

Plate 54, *L. Californicus*. — Plant, one-half size, and immature achenium, $\times 5$.

Plate 55, *L. depauperatus*. — Plant, natural size; achenium and cross-section of the same, $\times 5$.

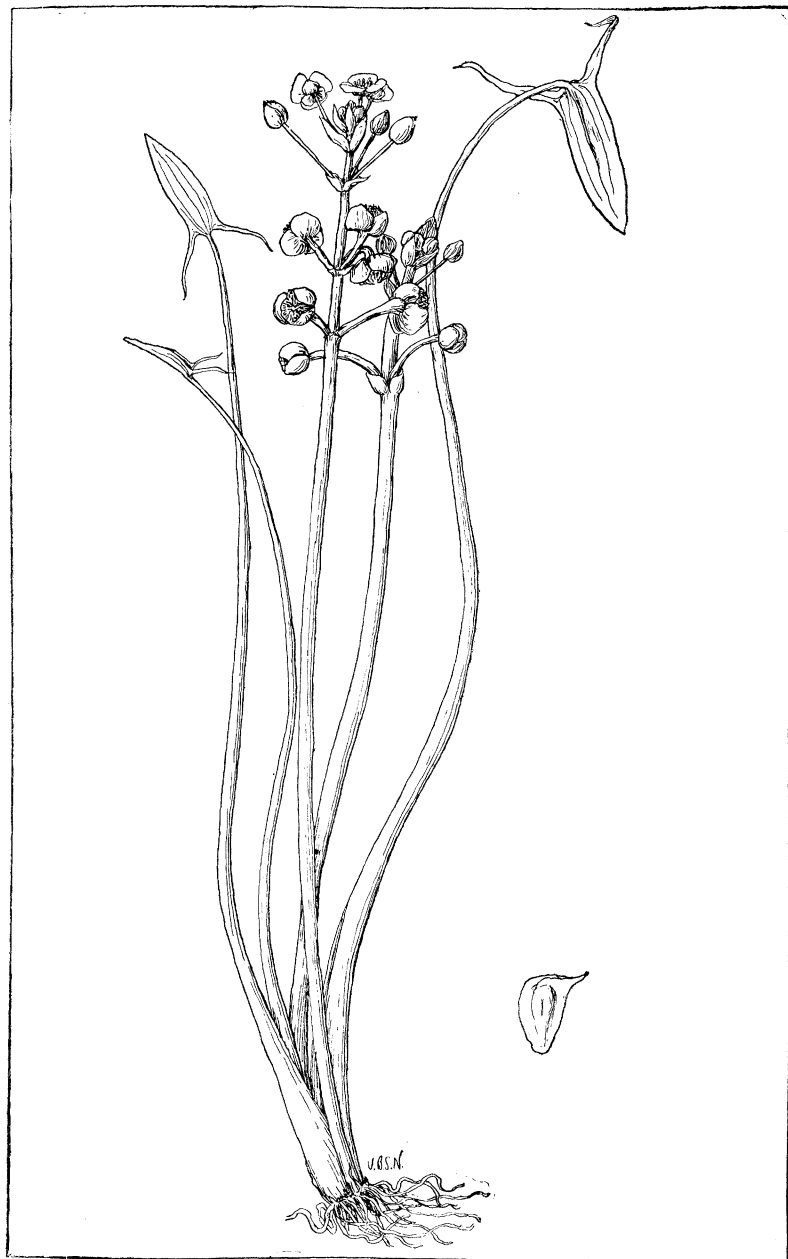
Plate 56, *L. spongiosus*. — Plant, one-half size; achenium and cross-section of the same, $\times 5$.

Plate 57, *L. spatulatus*. — 1, Plant, natural size; 2, sepal, $\times 5$; 3, petal; 4, stamen, $\times 20$; 5, achenium with cross-section, $\times 10$.

Plate 58, *Sagittaria Eatoni*. — 1, Plant, one-half size; 2, flowering branch, one-half size; 3, sepal, $\times 5$; 4, petal; 5, stamen; 6, pistil.



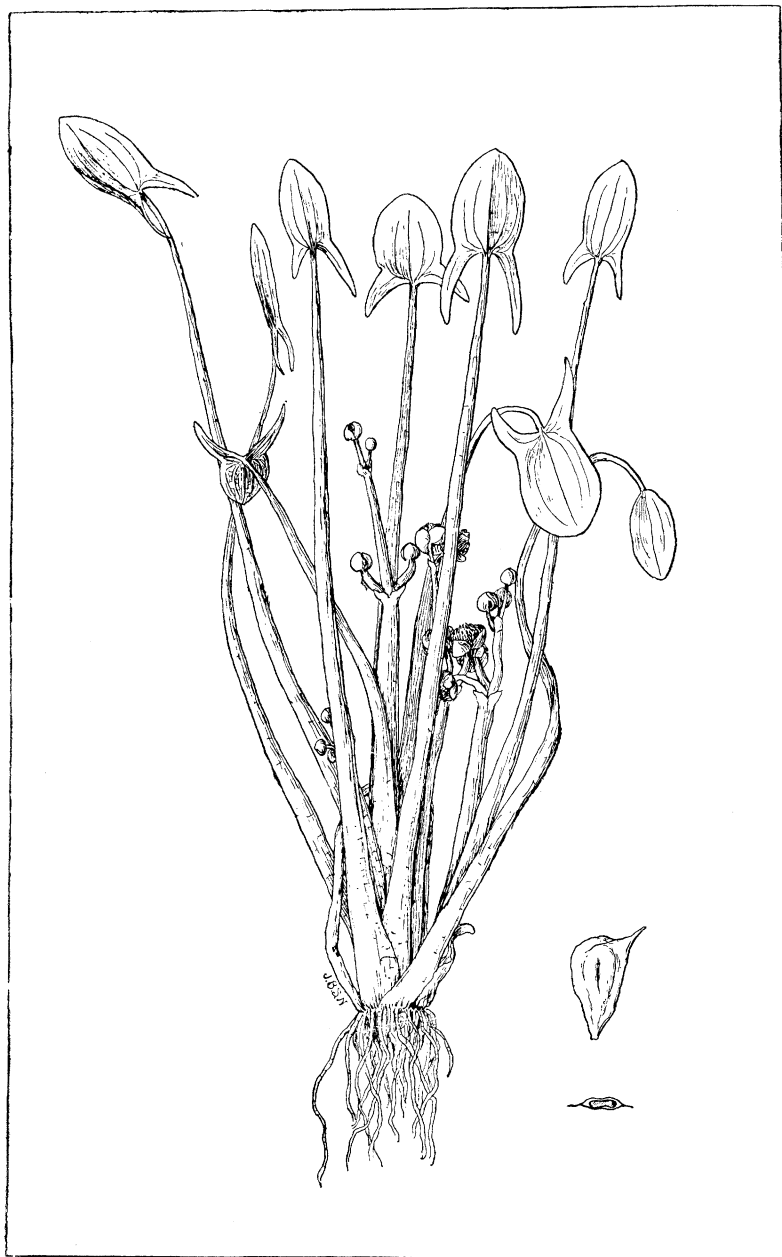
LOPHOTOCARPUS FLUITANS.



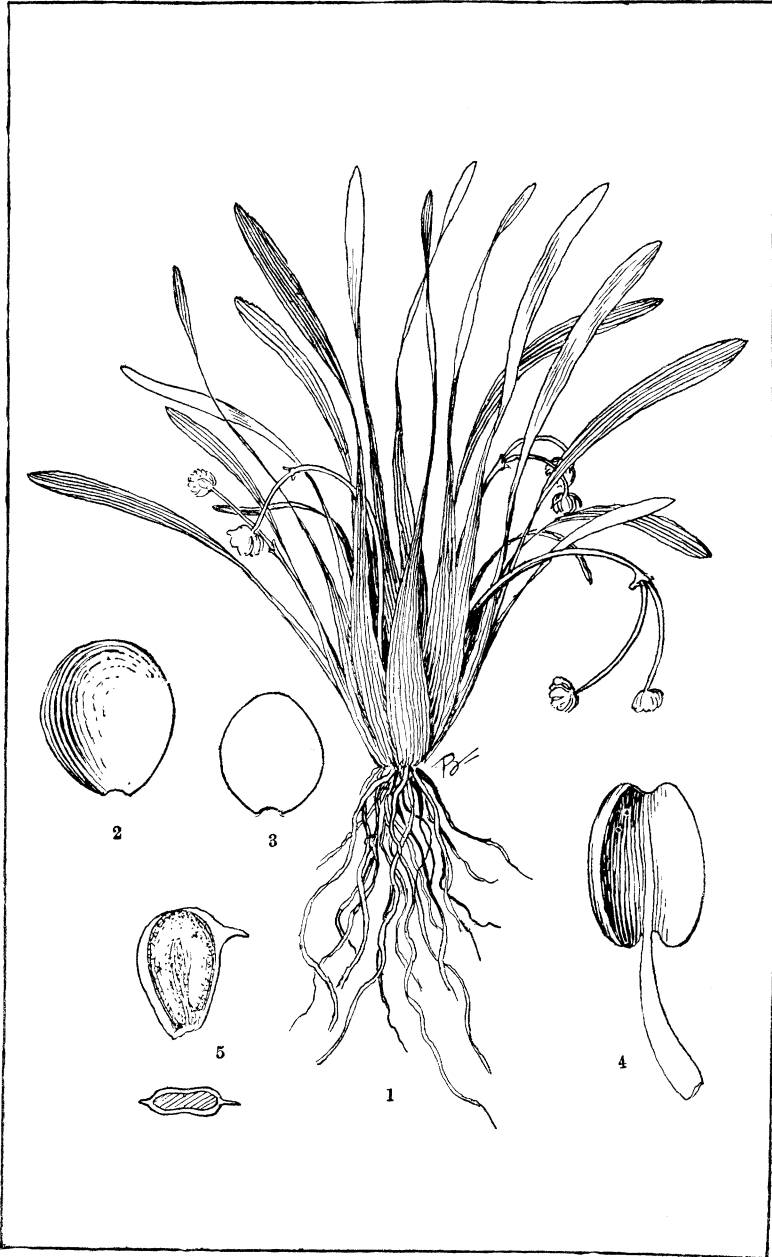
LOPHOTOCARPUS CALIFORNICUS.



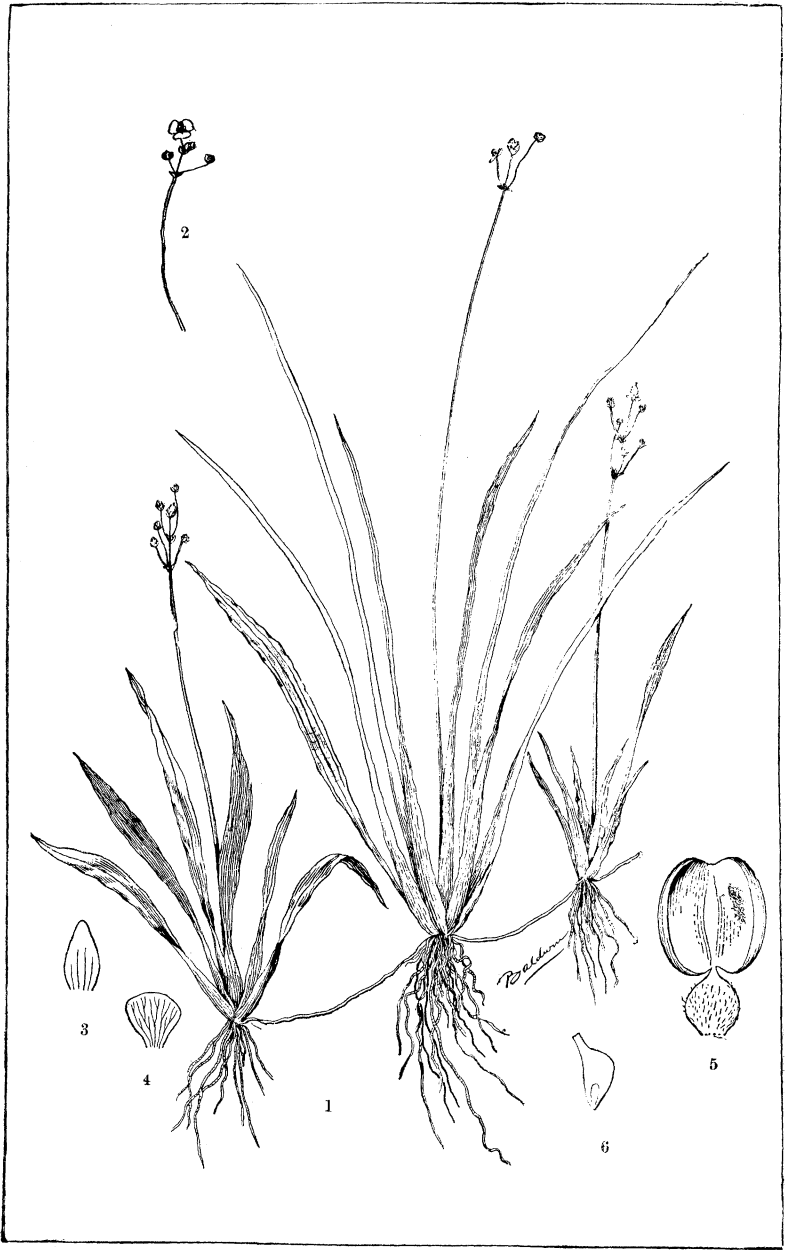
LOPHOTOCARPUS DEPAUPERATUS.



LOPHOTOCARPUS SPONGIOSA.



LOPHOTOCARPUS SPATULATUS.



SAGITTARIA EATONI.